

# Indiana's 5-year Surface Water Monitoring Strategy

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## Biographical Sketch of Author

Art Garceau is the Chief of the Surveys Section of the Office of Water Quality, Indiana Department of Environmental Management. He supervises the surface water quality monitoring of the State's rivers and streams, collecting physical and chemical parameters. In his position he is responsible for maintaining the collected data, issuing reports of the monitoring activities, distributing data to many and varied users, and assessing data for CWA 305(b) submissions. The Author has contributed to the review and issuance of the monitoring strategy and has the responsibility to implement a portion of it. The complete strategy is summarized in this paper.

## Abstract

In 1995, the Indiana Department of Environmental Management's Office of Water Quality (OWQ) Assessment Branch developed a proactive monitoring strategy for surface waters. The Strategy was revised in 1998 due to differing resource and TMDL needs. After completing the first rotation of watershed monitoring during 1996-2000, the Strategy was re-evaluated, modified, and updated.

The five-year monitoring cycle listed below will accomplish the second spatially complete surface water quality survey:

- West Fork White River and Patoka River Basins in 2001;
- East Fork White River and Whitewater River Basins in 2002;
- Upper Wabash River Basin in 2003;
- Lower Wabash River and Kankakee River Basins in 2004; and
- Great Lakes and Ohio River Basins in 2005.

The Assessment Branch program areas are the Biological Studies Section, Surveys Section, and the Toxicology and Chemistry Section which includes the TMDL group.

Sampling efforts are divided into the following categories:

- Statewide Monitoring: Sampling of the Lake Michigan shoreline and selected rivers on a monthly basis each year.
- Rotating Basin Monitoring: Probabilistic sampling of each basin once every five years according to the *Strategy* planning schedule; limited follow-up monitoring to identify sources of impairment; *E. coli* at targeted recreational sites; pesticides at targeted USGS gage sites through 2001.
- TMDL: Sampling of waterbodies on the 303(d) list.
- Other Support: Special surface water sampling projects to assist program areas.

Results of biological, chemical, and physical data collections are used to evaluate each river basin separately.

Does anyone remember 1957? Does anyone remember the Studebaker Golden Hawk? Studebaker built a supercharged sports car, and Indiana began its Fixed Station surface water quality monitoring program in 1957. The significance of the Golden Hawk is that back then, staff had to use their own cars, and a car like this was used to monitor water quality. Twenty years later, Federal legislation promoted additional monitoring program development.

Ten years after that, by the late 1980s, 30 years of surface water sampling in Indiana resulted in 50% of the State's rivers and streams being sampled only once, and 30% had never been sampled! According to the Indiana Administrative Code, the goal is "to restore and maintain the chemical, physical, and biological integrity of the waters of the State." In the early 1990s, it was realized that past practices and resources were not sufficient to meet the State's goal.

What to do? How can the Office of Water Quality generate the primary data necessary to determine if the State's goal is being met? The answer was that by 1995 the best minds of that day developed a new Surface Water Quality Monitoring Strategy for all of Indiana's surface waters.

The new strategy was first implemented in 1996 and included a 5-year rotating basin approach. About 20% of the State would be sampled each year on the following schedule:

- West Fork White River and Patoka River Basins in 1996
- East Fork White River and Whitewater River basins in 1997
- Upper Wabash River Basin in 1998
- Lower Wabash River and Kankakee River Basins in 1999, and
- Great Lakes and Ohio River Tributary Basins in 2000.

The Programs of the original strategy included:

- Watershed Probabilistic Sampling
  - ✓ Water Samples (only 1 time)
  - ✓ Macroinvertebrate communities
  - ✓ Fish communities
  - ✓ Fish tissue
  - ✓ Habitat assessments
  - ✓ Sediment contaminants
- Synoptic Sampling (~100 sites)
  - ✓ Sampled 6 times
- Lake Monitoring
- Fixed Station Monitoring (~106 sites)
- *E. coli* sampling
- Second year (Source Identification) Studies
- NPDES Waste Load Allocation Support
- Special Projects
- Core Macroinvertebrate and Fish Tissue sampling

A lack of sufficient personnel and funding for the strategy caused a major revision in 1998. The second year studies were never implemented, and were dropped from the strategy. Also dropped was Synoptic Sampling. The Probabilistic water sample sites were reduced, but sampling was increased to 3 times per site. A Pesticide monitoring program was added in 1997 that followed the rotating basin schedule, and the fixed stations were increased to 160 sites. Also, a TMDL sampling group was established.

After the first 5-year rotation, the strategy was reviewed by staff. The complete strategy and all of its programs were scrutinized for appropriateness and "do-ability." New programs were suggested and examined. The strategy was finalized, hopefully, for the next 5 years.

The new strategy continued the statewide monitoring programs and reiterated the rotating basin monitoring concept. The statewide continuing programs are: sampling monthly at 160 Fixed Stations, including 15 pesticide sites, sampling dissolved metals at nanogram per liter detection limits, and special projects that include investigations, enforcement support and NPDES support. The rotating basin monitoring includes watershed probabilistic monitoring, TMDL sampling, *E. coli* sampling, lake monitoring, and source identification sampling. Again, the watershed probabilistic sampling includes; water samples 3 times, macroinvertebrate communities, fish communities, fish tissue, habitat assessments, and sediment contaminants.

The Fixed Station Program objectives include: reveal water quality trends under changing conditions, provide data for existing and prospective users of surface water in Indiana, and pollution abatement activities such as review of nonpoint source effects. The expected program products are a report of the results and data available for requests.

The Pesticide Program will determine ambient concentrations of pesticides in surface waters at 15 Fixed Station sites co-located with USGS gaging stations. This will identify trends associated with agricultural runoff as determined by loading calculations.

The Trace Metals project is to measure dissolved and total recoverable metals in ambient waters using “Clean Sampling Techniques” and ultra-clean analytical test methods. This will develop in-house expertise for sampling ambient waters for metal analysis at trace levels. The basis for this project is the State Wide Water Quality Criteria (WQC) for Metals (Acid Soluble Fraction), WQC for Great Lakes Basin (Dissolved Metals), and WQ Effluent Limits (Total Recoverable Metals.)

Special Projects consists of anything not covered by a specific program. Examples of special projects include stream reach surveys, enforcement sampling, and biological concerns, such as, unusual odor or look to water, foaming, and fish kills.

The watershed probabilistic sampling objective is to sample randomly selected sites throughout major river basins to assess and characterize overall surface water quality through the integration of chemical, physical, and biological parameters.

Macroinvertebrate community samples are collected at core stations and at probabilistic sites if suitable conditions exist for collection methods. The samples are identified to the family level, and used in assessments for many programs.

Fish Tissue samples are collected at core stations and when available from probabilistic sites. Whole fish and fillets are collected to provide information on chemical contaminants that may be accumulating in the tissues and edible portions of fish. The information is used in assessments for several programs and supports the Indiana Fish Consumption Advisory that is an Indiana State Department on Health product.

A key component of the probabilistic approach is fish community evaluation. The objective is to identify impaired streams or watersheds by species information, and plugging the information into an index to define fish community health or condition. This evaluation aids the assessments of various programs as well as aids the development of expectations for biological criteria.

The habitat assessments utilize Ohio's Qualitative Habitat Evaluation Index or QHEI. Stream habitat is assessed during sampling to determine if the site's specific habitat degradation or poor water quality may be a cause for any impaired biological communities. The data collected for the index is substrate type (i.e. origin, quality, and embeddedness), instream cover, channel morphology, riparian zone and bank erosion, and pool/glide and riffle/run quality.

In order to provide information on chemical contaminants that may be accumulating in the sediments of a site, composite grab samples of surficial aquatic sediments are taken from rivers, streams, reservoirs, and lakes. Again, the data are used for assessments for many programs.

Total Maximum Daily Load sampling objectives are to characterize parameters of concern, to develop TMDLs that will ensure the attainment of water quality standards, and to implement the TMDLs through point and nonpoint source programs. The sampling locations are impaired waterbodies from the 303(d) list developed from the other monitoring programs. The sampling frequency is determined by the parameter of impairment and the location in the watershed of the impaired waterbody.

The bacteriological standard for recreational waters in Indiana is *E. coli*. The objectives of the *E. coli* sampling are to determine ambient concentrations in surface water and to provide benchmark data for long term trend analysis along with a broad scale overview of water quality. The analysis uses Method 9223-SM Enzyme Substrate Coliform Test to derive a Most Probable Number. As with all the programs, physical parameters such as temperature, pH, dissolved oxygen, conductivity, and turbidity are collected during each sample event.

To facilitate the collection of *E. coli* data, a mobile laboratory was procured. The advantages of the mobile laboratory are that it eliminates the necessity of transporting samples to a fixed laboratory within the 6-hour holding limit; staff can collect, prepare, incubate, read, and dispose of up to 40 samples per day; and it increases efficiency by completing analysis in the field.

Up until now, we have been discussing monitoring mostly rivers and streams. Lake monitoring provides information on the status and trends of the trophic state of public lakes and reservoirs. Chemical, physical, and biologic samples are collected from the lake. One fifth of 600 sites are sampled during July and August, and 100 volunteer sites are sampled from May to October.

The Source Identification program monitors water quality in streams at problem sites to ascertain the existence of ongoing deleterious water quality conditions and the source(s) of those conditions. Sampling locations are selected from the previous year's sampling, which is why this program is sometimes referred to as "second year studies."

This strategy is believed to be an extensive, comprehensive strategy, and a plan for success. However, the State's budget crunch this year has dictated some "dis-investment." The reduced resources have caused a reduction in probabilistic sites, 25% less *E. coli* sampling, no source identification program, and a 10% reduction in macroinvertebrate sampling.

The results of the chemical, physical, and biological data collection programs are used to evaluate each river basin separately. Typical products are presentations to universities, conferences and public demonstrations, development of reports such as the 305(b) report, 303(d) list and submissions to peer reviewed journals, and supporting data and information for NPDES permits, the fish consumption advisory, drinking water source protection, and IDEM Commissioner initiatives.